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LEFT ANTERIOR HEMIBLOCK (LAH)--DIAGNOSIS AND AEROMEDICAL RISK,(U)
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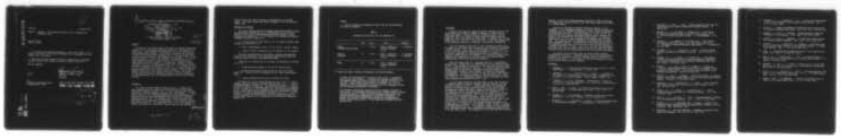

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SUBJECT: Abstract - Left Anterior Hemiblock (LAH)--Diagnosis and Aeromedical Risk

HQDA (SGRD-AJ)
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1. In compliance with USAMRDC Supplement 1 to AR 360-5, dated 7 Sep 76, a copy of the paper "Left Anterior Hemiblock (LAH)--Diagnosis and Aeromedical risk" is attached.

2. This paper has been cleared locally for presentation at the AGARD Aerospace Medical Panel meeting in London, England, 23-29 Oct 77.

FOR THE COMMANDER:

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LEFT ANTERIOR HEMIBLOCK (LAH)--DIAGNOSIS AND AEROMEDICAL RISK,

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(11) 1977

(12) 8p.

SUMMARY

Eighteen US Army initial flight applicants and trained aircrew were evaluated for the electrocardiographic diagnosis of left anterior hemiblock (LAH). This diagnosis was sustained in 50% by the addition of vectorcardiographic criteria. With computer processing and calculation of delay of the intrinsicoid deflection (ID) of the high lateral left ventricular activation time, the diagnosis was sustained in 50% of those records available. Review of the etiology, histopathology, and prognosis indicates definitive abnormalities of the trifascicular left bundle branch conduction system. It is essential a complete electrocardiogram (ECG) and vectorcardiogram (VCG) study of military aircrew be obtained to establish the diagnosis of true LAH. The incidence of true LAH is not available but the rarity of this finding with an unknown risk should preclude entry into military flight training. Complete cardiovascular evaluation of the trained airman with acquired LAH should include electrophysiologic studies and selective coronary arteriography and ventriculography prior to consideration for return to full flying duties.

BACKGROUND

The concept of left anterior hemiblock (LAH) by Rosenbaum was a major electrophysiologic advance in the delineation of cardiac interventricular conduction defects (1,2). In 1917 Rothberger and Winterberg provided the earliest evidence compatible with this concept (3). Subsequent advances in the noninvasive techniques of vectorcardiography and invasive His bundle electrocardiography have provided the definitive characterization of LAH. The etiology of LAH ranges from myocardial infarction and cardiomyopathy to hyperkalemia. These entities represent well defined risks (4). The aeromedical risk of LAH in the absence of apparent cardiovascular abnormality, however, has not been evaluated to

date for entry into flight training or continuation as an aircrew member. This study reviews the ECG/VCG diagnosis of LAH and its aeromedical risk.

MATERIALS AND METHODS

This study reviews a series of eighteen consecutive patients requiring aeromedical consideration due to interpretation of LAH from the standard 12-lead scalar electrocardiogram without evidence of other cardiovascular abnormality. The ECG criteria for inclusion are those of Rosenbaum, modified as noted (2,5).

a. Mean QRS (AQRS) in limb leads of -30^{0} or greater (modified from Rosenbaum's criteria of $\geq 45^{0}$).

b. Small Q deflections in lead I and AVL with QI and SIII pattern.

c. Normal to slight prolongation of QRS duration of ≤ 0.02 seconds.

Following identification of the patient, complete cardiovascular evaluation was conducted. Vectorcardiograms were obtained using the Frank lead system to define the conductive pathway.

Diagnostic VCG criteria for LAH are those as described by Benchimol et al. (6):

a. Counterclockwise rotation of QRS loop in frontal plane.

b. Superior displacement of the maximal and mean QRS vectors above -30^{0}. Initial 10 to 30 millisecond (msec) vector directed superiorly.

c. Delayed inscription of the 60 to 100 msec QRS vector.

For those ECG and VCG records obtained at the US Army A[illegible]dical Research Laboratory (USAARL), computer analysis (VCG-C) wa[illegible]cted by a modified Pipberger program (7). The intrinsicoid deflec[illegible]lay in AVL was utilized as an additional supportive criterion for th[illegible] diagnosis of LAH. Medrano et al., and Gallagher et al. have reported the regional delay in high lateral left ventricular activation due to block or interruption of the left anterior superior fascicle (8,9,10,11). A delay of 10 msec or greater for inscription of the intrinsicoid deflection in lead AVL when compared to V_6 is required for the additional diagnostic support (12).

RESULTS

Table I compares the diagnosis of LAH by ECG and the correlation with the VCG diagnosis.

TABLE I

DIAGNOSIS OF LAH BY ECG, VCG, AND COMPUTER VCG

	ECG	VCG	VCG-C	ETIOLOGY
Class I (initial entry aircrew)	5	2 (40%)	1 [VCG-C confirm of 3 ECG/VCG available (33%)]	2 Congenital
Class II (aircrew)	13	7 (54%)	1 [VCG-C confirm of 2 ECG/VCG available (50%)]	5 Congenital 2 Acquired*
TOTAL	18	9 (50%)	2 [VCG-C confirm of 4 ECG/VCG available (50%)]	

*1 patient had normal coronary arteriography and ventriculography.

As noted, VCG confirmation of "true LAH" occurs in 50% of suggestive ECG's by the usual criteria. The addition of computer analysis of the intrinsicoid deflection further supports the diagnosis of true LAH in only 50%. These findings require that as a minimum, a VCG must be obtained for flight applicants and aircrew prior to a diagnosis of true LAH and computer confirmation is desirable.

Two aircrewmen developed an acquired LAH which prompted inclusion in this review. One aircrewman with acquired LAH underwent complete cardiovascular evaluation to include selective coronary arteriography and ventriculography which demonstrated no definitive abnormality. One patient did not accept cardiovascular evaluation and subsequently, retired from military service. In both cases the crewmember was over the age of 35.

DISCUSSION

Extensive cardiovascular study of acquired complete right and left bundle branch block (RBBB and LBBB) has returned to flight status a significant number of highly skilled US military aircrew (13,14,15). Congenital RBBB in the absence of other congenital defects has been shown to be fully compatible with flying duty. Congenital LBBB has been unacceptable for entry into US Army and US Air Force flight training due to the increased incidence of associated cardiovascular abnormality.

Left axis deviation (LAD) AQRS of -30^0 or greater by scalar ECG in the absence of clinically apparent cardiovascular disease was considered a "normal variant" in the past. Previous studies of aircrew with LAD (prior to the LAH concept) indicate an incidence of 0.2 to 1.2% (16,17). The current enthusiasm of electrocardiographers in diagnosing LAH has provided a marked increase in incidence. The clinical pathologic implication of the diagnosis of LAH in the military aircrewman requires confirmation by the current available techniques.

Pryor and Blount found 80% of patients with LAD had significant cardiovascular disease with 84% demonstrating findings compatible with LAH (4). These findings of marked LAD or LAH have generally been attributed to myocardial fibrosis or necrosis. The etiology proposed includes coronary artery disease (CAD), hypertensive vascular disease (HVD), cardiomyopathy, congenital heart disease, and metabolic derangement (hyperkalemia). Epidemiologic studies to date are limited but indicate the probability of a benign prognosis for this isolated ECG/VCG abnormality (18,19). The controversy, however, remains concerning the underlying histopathology producing true LAH or LAD.

The left bundle branch has now been shown to have three fascicles: the anterior superior fascicle, posterior inferior fascicle, and the mid-septal fibers (20,21,22). A recent quantitative histopathologic study of left bundle branch fibrosis with LAH in the face of known cardiovascular disease indicates a greater distribution of fibrosis in the conduction system than expected from the ECG abnormality (23). Inconsistencies in the specific location of the lesion to the anterior fascicle have been demonstrated (24). There is general agreement for the concept of a diseased left bundle branch system as well as coexisting cardiac lesions involving the septal and parietal walls of the left ventricle in patients with the ECG finding of LAH (23,24). Congenital LAH, on the other hand, has received limited attention as to histopathology or prognosis. The incidence of RBBB and LBBB in children is not well defined (25,26). It is unusual, however, to find an asymptomatic individual without other cardiovascular abnormality below the age of 30 with LBBB (27,28). The incidence of LAH has not been fully defined.

however, in view of the known decreased incidence of LBBB in the young. It follows that a fascicle lesion of the left bundle would also be found in a limited number.

True LAH is supported by ECG/VCG criteria in only 50% of ECG diagnoses. It is considered essential all initial flight applicants and trained aircrew be evaluated by available ECG/VCG studies to establish the diagnosis of true LAH. From this review, LAH by ECG and VCG supported by ancillary computer techniques provides primary evidence for a defect of the trifascicular left bundle branch system. The long-term prognosis of LAH in the young asymptomatic aircrewman remains questionable. This prognosis would be expected to be determined by the underlying pathologic process. The subtleties of idiopathic degeneration of the conduction system would place the young flight training applicant in a category considered "at risk." Thus, it is proposed that individuals with true LAH be excluded from entry into the high cost military flight training program and the intense stress of the combat flight environment.

The trained airman acquiring true LAH should receive complete cardiovascular evaluation. Evaluation should include electrophysiologic studies of the conduction system and selective coronary arteriography with ventriculography. In the absence of definitive abnormality, return to full flying status would be indicated.

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